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ABSTRACT

In fall 1990, Johnson County Community College (JCCC) in Overland Park, Kansas, conducted a study of the effectiveness of the college's developmental reading, English, and mathematics courses. The study examined developmental students' course grades and completion rates, grades in related college-level courses, overall academic progress, and scores on standardized assessment tests taken before and after the developmental course. The study population included 1,011 students enrolled in developmental reading from fall 1986 through spring 1990, 292 students enrolled in developmental English in fall 1990, and 1,126 students enrolled in developmental mathematics courses between fall 1986 and fall 1990. Study highlights included the following: (1) students in developmental reading and English courses showed significant gains on standardized tests near the end of their remedial courses; (2) students in developmental courses completed approximately 20 credit hours at the college; (3) developmental students' grade point averages (GPA's) dropped significantly in the semester following their developmental work, but then increased gradually; (4) developmental students generally achieved passing grades in college-level courses related to their developmental courses, though both their grades and course completion rates were lower than the college-wide averages in those same courses; and (5) developmental reading students graduated (i.e., received a degree or certificate) at a rate slightly more than one-half that of the student body as a whole. Also, developmental English students' graduation rates approximated those of students college-wide, while developmental math students graduated at a rate nearly twice the college-wide average. Detailed data tables are included. (PAA)

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Assessing the Outcomes of Developmental Courses at Johnson County Community College

Office of Institutional Research

Johnson County Community College

August 1992

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JC920439

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Office of Institutional Research
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August 1992

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EXECUTIVE SUMMARY

In the fall 1990 semester the Johnson County Community College Office of Institutional Research undertook a comprehensive study of the effectiveness of the college's developmental reading, English, and mathematics courses. In general, the study examined students' developmental course grades and completion rates, their grades in related college level courses, their academic progress and performance, their scores on standardized assessment tests taken before and after the developmental course, and the relationships between those pre- and post-semester assessment scores and grades earned in the developmental course. Records were examined and data collected for the semester students enrolled in developmental courses, and, where applicable, for subsequent semesters to track their academic performance and progress at JCCC.

The major findings of the study were as follows:

1. Students in developmental reading and English courses showed significant gains on standardized assessment tests (and, presumably, in reading and English performance) near the end of those courses. Post-semester assessment scores were not available for students in developmental math courses. In addition, small but statistically significant positive correlations were obtained between pre- and post-semester assessment scores and grades in developmental courses.

2. Developmental course successful completion (i.e., passing) rates ranged from less than 40% in some developmental math courses to more than 90% in developmental reading. Average grades in these courses generally fell in the C range.

3. On the average, students in developmental courses completed a total of approximately 20 credit hours at the college and earned GPA's in the C to C+ range.

4. Developmental students' GPA's typically dropped significantly in the semester following their developmental coursework, but then gradually increased to a point at or slightly below their initial grade level.

5. In general, developmental students achieved passing grades in college-level courses related to their developmental courses. However, both their grades and successful completion rates were lower than the overall college averages for those related courses.

6. Developmental reading students graduated (i.e., received a degree or certificate) at slightly more than one-half the rate of the student body as a whole. Developmental English students' graduation rates approximated those of students college-wide, while developmental math students graduated at a rate nearly twice that of students overall.

INTRODUCTION

Johnson County Community College has maintained, since its founding, an open-access admissions policy. This policy, shared by the vast majority of American public two-year community and junior colleges, allows any individual (generally 18 years of age or older or a high school or GED graduate) to enroll in credit courses if certain conditions are met (e.g., completion of an application for admission and, in most cases, of an entry level assessment/placement test). A major result of this "open-door" policy has been the enrollment of large numbers of students underprepared for collegiate level coursework.

Thus, the college has had to offer an increasing number of "remedial" or "developmental" courses designed, theoretically, to bring these students to the point where they could successfully complete collegiate level work. For example, in the fall 1991 semester the college offered 209 sections of below college-level reading, English, and mathematics courses. These courses enrolled 4,707 students, accounting for 13,666 credit hours, or 11.7%, of the college's credit offerings that semester. This commitment of college resources to developmental education is not unusual. In fact, such educational services have become an increasing component of most community colleges' missions (e.g., Cohen & Brawer, 1983, Lombardi, 1979, Donovan, 1985, Lederman, Ribaudo, and Ryzevic, 1985).

This remedial effort has generated considerable controversy for the community college movement (Quinley, 1990). On the one hand, there is a clear need in communities served by two-year colleges for this type of compensatory education. Surveys of business and industry generally reveal that one of their greatest education/training needs is for improvement in employees' basic reading, writing, and numeracy skills. In addition, community colleges generally have long histories of providing these services.

On the other hand, there is increasing criticism from various constituencies, particularly given the recent climate of decreasing tax revenues and growing budget constraints, that taxpayers should not have to pay twice for this skills development training. The assumption is that such training is the responsibility of the elementary and secondary sectors of the educational system. This notion ignores, however, the diversity of today's community college student population; a large proportion of students needing basic skills remediation are older returning students whose experience in secondary education may have been decades earlier. In any case, these arguments opposing delivery of remedial coursework have not gone unnoticed in community colleges and have been given considerable recent credence by influential authors who are both critical of the breadth of extant community college missions and the degree to which colleges have succeeded (or failed) in the performance of those missions (e.g., Brint & Karabel, 1989; Clowes & Levin, 1989, McGrath and Spear, 1991; Richardson, Fisk, and Okum, 1983; Zwerling, 1976, 1986).

Given that remedial/developmental education is a large and growing component of the missions of a majority of two-year colleges--and that the controversy that has accompanied it is also growing--the assessment of the outcomes and effectiveness of those courses has taken on increasing importance as the

movement toward assessment of community college services becomes more prevalent. It is thus somewhat surprising that there are so few published reports of such systematic assessments (although there are a few, e.g., Cohen, 1973; Morante, 1985). In fact, Alfred and Lum (1988) concluded that there has been insufficient research to determine whether remedial programs are successfully meeting student needs. As a result, in the fall of 1990, the Johnson County Community College Office of Institutional Research undertook a systematic, comprehensive research project designed to assess the outcomes and effectiveness of developmental reading, English, and mathematics courses at the college. The project utilized a variety of methodologies to examine students' scores on standardized assessment tests taken before and after their developmental courses; the relationships between pre- and post-semester assessment test scores and students' grades in developmental courses; students' developmental course grades and completion rates; their grades in related college-level coursework, taken both concurrent with and subsequent to their developmental courses; and their overall academic progress and performance. (In some cases unavailability of necessary data precluded examination of one or more of these variables.)

In general, students' records were examined and data collected for the semester they enrolled in a developmental course and, when applicable, for subsequent semesters, to track their academic performance and progress. Additional details of methods used will be described for each component of the project as appropriate.

Finally, assessing the effectiveness of developmental courses is difficult since the purposes or specific desired outcomes of these courses are often not clearly articulated. The Johnson County Community College mission statement mentions basic skills development and remediation to help students benefit from academic programs. What does "benefit" from academic programs mean? Is it achievement of functional literacy, significant gains in basic skills, successful completion of college-level courses, receipt of a degree or certificate, or some or all of the above? One purpose of this project was to attempt to sort out at least some of these issues.

READING

The purpose of this study was to explore relationships between students' performance in developmental reading courses, scores on the Comprehension and Vocabulary subtests of the Stanford Diagnostic Reading Test, performance in college-level work, and the duration and outcomes of their association with the college. The college offers two developmental reading courses which enroll a sufficient number of students to permit statistical analysis and tracking of academic performance and progress. These are Fundamentals of Reading (LC 125) and Reading Skills Improvement (LC 126). The former is a basic level reading course focussing on the development of a sight vocabulary, word recognition, multiple meanings of words, and literal comprehension and recall. The latter course reviews skills taught in LC 125 and focuses on analytical reading skills, study techniques, flexible reading rate, and vocabulary. Data for this portion of the project were collected from 1,011 students who were enrolled in LC 125 (n = 252) and LC 126 (n = 759) from fall 1986 through spring 1990.

Personnel from the Academic Achievement Center administered the Stanford Diagnostic Reading Test to students at the beginning and the end of the semester in each LC 125 and LC 126 course. These data were forwarded to the Office of Institutional Research in the form of percentile rank scores. JCCC academic data (GPA's, LC 125 and LC 126 grades, related course grades, and credit hours completed) were collected from students' transcripts. Not all data elements were available for all students and thus the tables and discussion which follow may reflect slight variations in numbers of students involved.

Table 1

DEVELOPMENTAL READING STUDENTS' ACADEMIC PERFORMANCE
IN THE DEVELOPMENTAL READING COURSE

	Course			
Variable	LC 125	n	LC 126	n
Average Grade	2.78	244	3.10	714
Successful Completion	91.7%	231	90.8%	689
Stanford Diagnostic Scores (percentile rank)				
Comprehension				
pretest	9.5	232	20.0	676
posttest	16.2	232	32.3	676
Vocabulary				
pretest	20.7	238	35.2	670
posttest	33.6	238	48.1	670

Note: All pretest-posttest differences are significant ($p < .05$).

Academic Performance

Table 1 depicts data pertaining to students' academic performance and pretest/posttest gains on the comprehension and vocabulary subtests of the Stanford Diagnostic Reading test. The average developmental reading course grade was in the B range and slightly more than 90% of students in those courses received a passing grade (i.e., D or higher).

Pretest/posttest differences on the Stanford Diagnostic Reading Test were evaluated using correlated t-tests. As is evident from the table, students in both LC 125 and LC 126 made significant gains over the semester on both the comprehension and vocabulary subtests of the Stanford Diagnostic.

Thus, it appears that most of the students in these courses performed at an acceptable (i.e., passing) level. The vast majority of them successfully completed the course in which they were enrolled and made significant gains in their reading ability.

Relationships Between Stanford Scores and Reading Course Grades

Pearson correlation procedures were used to evaluate the relationships between pre- and posttest scores on the Stanford Diagnostic Reading Test and grades in JCCC developmental reading courses. As can be seen in Table 2, low but statistically significant positive relationships were observed for both subtests in the two courses at the beginning and end of the semester. These relationships were markedly stronger late in the semester in three out of four cases, a finding that would be expected given the gains in test scores noted above and the assumption that the Stanford measures at least some of what students learned in the developmental course.

Table 2

RELATIONSHIP BETWEEN STANFORD SCORES AND COURSE GRADES
FOR DEVELOPMENTAL READING STUDENTS

	Course					
	LC 125			LC 126		
Stanford Scores	r	r^2	n	r	r^2	n
Vocabulary Pretest	.19	.036	172	.21	.044	641
Vocabulary Posttest	.27	.073	168	.31	.096	596
Comprehension Pretest	.19	.036	170	.11	.012	633
Comprehension Posttest	.17	.029	166	.26	.068	614

Note: All correlations are significant ($p < .05$).

These findings also indicate that scores on the Stanford account for only a small portion of the variability in LC 125 and LC 126 grades (from 1.2% to 9.6%). This result should not be a major concern, however, since grades are a complex multi-determined variable.

Academic Progress

Table 3 presents the results of several analyses regarding developmental students' academic progress at the college; these results are summarized below.

Table 3

DEVELOPMENTAL READING STUDENTS' ACADEMIC PROGRESS

Variable	Course LC 125	n	LC 126	n	
GPA[a]	2.37	181	2.57	670	
GPA Next Semester[b]	1.70[c]	141	1.94[c]	553	
GPA Two Semesters Later	1.68	94	2.01	389	
GPA Three Semesters Later	2.01	61	2.25	238	
GPA Four Semesters Later	2.19	44	2.25	144	
Developmental Course Grade and Subsequent Credit Hours					
Average Grade	2.85		3.14		
Subsequent Credit Hours Earned	21.9		18.6		
Correlation Coefficient	.31[d]		.20[d]		
Graduation Rates					Total
Certificates Awarded	-		7		7
Degrees Awarded	11		19		30
Total Graduates	11		26		37
Percent Graduating	4.4%		3.4%		3.7%
College-wide Entering Population	-		-		7.5%

Notes: [a] For the semester in which LC 125 or LC 126 was taken.
[b] Enrollment in semesters following the development course may not have been continuous and may have been interrupted by stopping out for some students.
[c] Significant difference between this and the prior semester ($p < .05$).
[d] Significant correlation ($p < .05$) between LC 125 and LC 126 course grade and subsequent credit hours earned.

Grades. The GPA's of LC 125 and LC 126 students actually decreased significantly in the semester following their enrollment in the developmental reading course. While the GPA's of students who continued to enroll improved in subsequent semesters, those GPA's only approximated the level of the LC 125/LC 126 semester. In addition, less than one-fourth of the students completed as many as four more semesters after taking either course.

Credit Hours. Small but statistically significant relationships were found between LC 125/LC 126 grades and credit hours completed in subsequent semesters. LC 125 students completed an average of 21.9 credit hours after taking the course, compared to 18.6 credit hours for LC 126 students. These findings indicate that there is some tendency for students with higher LC 125/LC 126 grades to complete more subsequent credit hours, although other factors also clearly contribute to subsequent enrollment.

Graduation. Of the slightly more than 1,000 students in this study, only 37 (4.1%) graduated (i.e., received a degree or certificate). This figure is conservative, since some of the students included in the study were enrolled in LC 125/LC 126 recently enough (fall 1989 and spring 1990) that they could not have been expected to graduate when these data were collected. Even so, it is clear that the vast majority of LC 125/LC 126 students do not go on to graduate from JCCC. However, it must be noted here that graduation rates of all community college students are historically very low (generally less than 15%). Thus, undue emphasis or concern should not be associated with this finding.

These data suggest that the assumptions regarding the reasons students enroll in developmental courses (and, therefore, the reasons these courses are offered) may need to be reexamined. The notion that developmental courses are preparing them for collegiate-level coursework and graduation may be at least partially inaccurate and/or unrealistic. Rather, some students may be using these courses to acquire functional literacy skills. Clearly this is an important societal function, but one which may necessitate rethinking the assumptions which underlie offerings of these courses.

Performance in Related Courses

Table 4 illustrates developmental reading students' grades in a group of college-credit level courses taken concurrently which are "related" in the sense that the reading loads in them are substantial. Identified in this

Table 4

DEVELOPMENTAL READING STUDENTS' PERFORMANCE
IN RELATED COURSES

Course	Overall Course Grade (Spring 1991)	LC 126 Students' Mean Grade	Correlation With LC 126 Grade	n
Psychology 130	2.72	2.20	.30	86
History 140	2.72	1.74	.49	35
Sociology 122	2.62	1.74	.41	27
Humanities 122	2.77	2.54	.65	26

Note: All correlations are significant ($p < .05$).group of reading-related

group were Psychology 130 (Introduction to Psychology), History 140 (U.S. History to 1877), Sociology 122 (Sociology), and Humanities 122 (Introduction to the Humanities). Information regarding performance in these courses was available only for those students enrolled in LC 126 since too few LC 125 students enrolled in them to justify statistical analysis.

Grades in the humanities, sociology and history courses demonstrated moderate and statistically significant relationships with LC 126 grades. Further, a relatively small but statistically significant relationship was found between LC 126 grades and grades in the psychology course. In other words, students' performance in the psychology, sociology, humanities, and history courses was related to their performance in LC 126. However, these students' grades in the history and sociology courses were well below average. Thus, the overall relationships between performance in LC 126 and related courses are not completely clear (in part due to the small numbers of students involved) but suggest that it may be inadvisable for students to enroll concurrently in LC 126 and content courses which require considerable reading, particularly history and sociology.

ENGLISH

The purpose of this study was to explore relationships between students' performance in development English courses, their concurrent and subsequent performance in college-level courses at JCCC in which facility in English seemed particularly important, and the duration and outcomes of their association with the college. The college offers one developmental English course which enrolls a sufficient number of students to permit statistical analysis and tracking of academic performance and progress. This course is Introduction to Writing (ENGL 106). Students in the course first review sentence skills, then move into writing paragraphs, with emphases on topic selection, organization, development, and editing. An introduction to the essay then follows. Two separate studies were conducted using data sets from different groups of ENGL 106 students. The methodologies and results of these studies are described below.

The English ASSET Study

Data for this study were collected from 292 students who were enrolled in English 106 during the fall 1990 semester. JCCC Testing and Assessment Center personnel administered the ASSET (English subtest) to the students during the spring 1990 and/or summer 1990 semesters. In this manner, 241 students took the pre-ASSET. All 292 students were post-tested on the ASSET near the end of the fall 1990 semester (at the end of English 106). JCCC academic data (English 106 grades and related course grades) were collected from students' transcripts.

Students' pre- and post-ASSET scores were analyzed for differences utilizing correlated t-test procedures. Further, Pearson correlation procedures were utilized to test for correlations between pre- and post-ASSET scores and English 106 grades and between English 106 grades and grades in related courses taken during the same term (Psychology 130, History 140, Sociology 122, and Humanities 122). Examination of representative syllabi from those courses indicated that a significant amount of writing is required in each, as well as the reading requirements noted in association with the reading study described earlier. Among the types of writing required in the related courses were the following: essay exams, essays, emphasis on well-written notes and note-taking ability, written quizzes, book reports and reviews, diaries, research papers, identify-and-define quizzes, term projects, reports on field trips, reviews of concerts and plays, in-class writings, and applying concepts in writing.

Results

Table 5 depicts data comparing pre- and post-ASSET scores. Developmental English students made statistically significant gains on the English ASSET subtest during the course of the semester. This finding suggests that students' experience in ENGL 106 produced small but significant gains in their English skills, at least as measured by the appropriate ASSET subtest. Further, low but statistically significant correlations were observed between ENGL 106 grades and pre- and post-ASSET scores. These findings indicate that scores on the ASSET English subtest account for only a small portion of the variability in ENGL 106 grades (7.8% and 3.2% for pre- and post- respectively). These correlations, while low, are similar to those observed

Table 5

DEVELOPMENTAL ENGLISH STUDENTS'
PRE- AND POST-ASSET SCORES

	PRE-ASSET	POST-ASSET
Mean	37.3	40.1[a]
n	241	241
Correlation with ENGL 106 Grades	.28[b]	.18[b]
n	237	288
r^2	.078	.032

Notes: [a] Significant difference between pre- and post-ASSET scores ($p < .05$).
[b] Significant correlation ($p < .05$).

for the developmental reading courses (cf. Table 2). As was the case for reading, however, these results should not be of major concern since, as was noted earlier, grades are a complex, multi-determined phenomenon.

Table 6 details data regarding developmental English students' grades in ENGL 106 and related courses. It is clear that this group of students performed at a C to C+ level in ENGL 106, and in the psychology and humanities courses; and at a somewhat lower level in the sociology and history courses. Also, ENGL 106 semester and cumulative GPA's approximated college-wide averages, generally in the C+ range.

Table 6

ENGL 106 AND RELATED COURSE GRADES

Course	Mean Grade	n	Correlation with ENGL 106 Grade
English 106	2.63	288	
Psychology 130	2.49	65	.61[a]
History 140	1.85	27	.29
Sociology 122	1.67	30	.40[a]
Humanities 122	2.00	16	.38
Semester GPA	2.56	288	-
Overall GPA	2.54	288	-

Note: [a] Significant correlation ($p < .05$).

In addition, there was a strong statistically significant relationship between ENGL 106 and grades in Psychology 130; and a moderate, statistically significant relationship between ENGL 106 and grades in Sociology 122. The relationships between ENGL 106 grades and grades in concurrent History 140 and Humanities 122 courses were not statistically significant. While interesting, care should be taken to not over-interpret these findings since they might be influenced by the small numbers of students involved (particularly in the humanities course) and by the possibility that the courses related to ENGL 106 required different amounts of writing.

Generally, the results of this study, which demonstrate a relationship between the ASSET entry-level assessment subtest and developmental English grades, indicate that the instrument has some value as an entry-level assessment and placement tool. However, this relationship is not particularly strong, suggesting that the placement cutoff scores may require some adjustment.

The meaning of the data demonstrating the relationships between grades in ENGL 106 and related courses is also somewhat unclear. These relationships will be investigated further in the next study.

The English Cohort Study

The purpose of this study was to explore relationships between the performance of a cohort of students in developmental English courses--those taking the courses in fall 1986--and their concurrent and subsequent performance in related college-level courses at JCCC, as well as the duration and outcomes of their association with the college. As noted, Introduction to Writing (ENGL 106) enrolls a sufficient number of students to permit statistical analysis and tracking of academic perfomrance. Transcripts were obtained from the 524 students who had enrolled in ENGL 106 during fall 1986. These transcripts were examined for the four-year period between fall 1986 and the end of the fall 1990 semester in regard to the following data elements:

1. Grades from ENGL 106 and six related courses requiring writing which were attempted and/or completed during the four-year period;
2. Degrees or certificates awarded by the end of the fall 1990 semester;
3. The number of semesters in which classes were taken after fall 1986;
4. Semester GPA's earned between fall 1986 and fall 1990;
5. Cumulative GPA's (as of fall 1990); and
6. Number of credit hours earned at JCCC as of fall 1990.

These data elements from students' academic records were analyzed and the following sections of this report describe the major short- and long-term effects associated with enrollment in ENGL 106.

Students' Performance in English Courses

Data were collected regarding students' grades and completion rates in ENGL 106. In addition, these grades were correlated with those in the standard freshman-level composition course (ENGL 121) for those students in the fall 1986 developmental cohort who subsequently enrolled in that course. Analyses revealed that 69.7% of the students enrolled in ENGL 106 successfully completed the course (i.e., passed) and the average course grade was in the C range (2.27). Between fall 1986 and fall 1990, 246 of these students successfully completed ENGL 121. A strong relationship was evident between grades in the two courses ($r = .53$, $p < .001$). In other words, students who made higher grades in ENGL 106 also tended to do well in the freshman

composition course. In fact, ENGL 106 grades accounted for more than one-fourth of the variability in ENGL 121 grades, suggesting that ENGL 106 does a good job of preparing students for freshman composition, based on data from those developmental English students who subsequently enroll in the freshman composition course.

Overall Academic Performance and Progress

Tables 7 and 8 depict the results of several analyses regarding developmental English students' academic progress at the college; these results are summarized below.

Table 7

DEVELOPMENTAL ENGLISH STUDENTS' ACADEMIC PROGRESS

Variable	Mean	n
Fall 1986 GPA	2.16	440
GPA Next Semester[a]	1.94[b]	382
GPA Two Semesters Later	1.91[b]	307
GPA Three Semesters Later	2.29	236
GPA Four Semesters Later	2.12	178
Overall GPA Through Fall 1990--		
Students Taking Developmental English	2.07	440
Collge-Wide Entering Population, Fall 1986	2.75	3,608
Credit Hours Earned Through Fall 1990--		
Students Taking Developmental Course	20.63	440
College-Wide Entering Population, Fall 1986	14.20	3,608

Note: [a] Enrollment in semesters following the fall 1986 developmental course may not have been continuous and may have been interrupted by stopping out for some students.
[b] Each semester GPA was compared to the fall 1986 overall GPA using t-tests. Noted means are significantly lower than the initial, fall 1986 GPA ($p < .01$).

Grades and Credit Hours Earned. Table 7 provides data on the mean GPA's earned by students in the cohort as they proceeded through one or more semester's work in both developmental and college-level courses beginning with the fall 1986 semester. Of the 524 students who enrolled in ENGL 106 during the fall 1986 semester, 440 received a grade; the remaining 84 students withdrew or received an I in the course. Grade point averages were also calculated for each subsequent semester's work, based on the numbers of students from the fall 1986 cohort for whom successive semester GPAs were available. Table 7 contains mean grades from successively smaller groups of students--in essence, from those who persisted through several semesters. Clearly, as time went on, fewer members of the cohort continued to take courses at the college. The mean grade point averages of students in the

cohort fell following the fall 1986 semester, then returned to approximately the same level as that in fall 1986. In fact, as the table indicates, only the second and third semester's mean GPA's differed, at a statistically significant level, from the GPA earned during fall 1986. Moreover, students who had taken the developmental course in fall 1986 and continued to enroll achieved passing grades, on the average, during all five semesters.
Table 7 also conveys information on the academic progress of the entire cohort through the end of the fall 1990 semester. Across that four-year period, the 440 students receiving a grade in ENGL 106 accumulated an average of 20.63 credit hours and a mean cumulative GPA of 2.07. By comparison, the total of all 3,608 new students entering JCCC in fall 1986 (including those who took developmental courses and those who did not) had earned an average of 14.2 credit hours and an average cumulative GPA of 2.75 by the end of fall 1990.

Graduation. Table 8 shows that of the 524 students enrolled in ENGL 106 in fall 1986, 43 (8.21%) graduated (i.e., received a degree or certificate by the end of the fall 1990 semester). While low, this graduation rate compares favorably with that of the college-wide entering student population in fall 1986 (7.54%). It is important to recall here the earlier caveat regarding the low incidence of intent to graduate as an educational objective among students entering community colleges.

Table 8

GRADUATION RATES--DEGREES & CERTIFICATES EARNED AS OF FALL 1990--
FOR STUDENTS ENROLLED IN FALL 1986 DEVELOPMENTAL ENGLISH

	Number of Students Graduating	Total Fall '86 Enrollment	% Graduating Fall '90
Students Taking Developmental English (ENGL 106)	43	524	8.21%
College-Wide Entering Population (Fall 1986)	272	3,608	7.54

Performance in Related, College-Level Courses

Table 9 contains information on the successful completion rates and mean grades earned by the fall 1986 cohort in college-level courses "related" to developmental English during the four-year period of the study, in the sense described previously (p. 12); that is, according to their syllabi, success in all of the courses appears to rest heavily on a student's ability to write coherently. Identified as courses related to ENGL 106 were those noted previously in the ASSET study: PSYC 130 (Introduction to Psychology), HIST 140 (U.S. History to 1877), SOC 122 (Sociology), and HUM 122 (Introduction to the Humanities). For the cohort study, grades in HIST 141 (U.S. History Since 1877) and English 121 (Composition I--freshman composition) were also included with those from the other related classes.

Table 9

MEAN GRADES & SUCCESSFUL COMPLETION RATES
IN COURSES RELATED TO DEVELOPMENTAL
ENGLISH[a,b]

"English-Related" Courses	SAME SEMESTER n	SAME SEMESTER % Success	SAME SEMESTER Mean Grade	SUBSEQUENT SEMESTERS n	SUBSEQUENT SEMESTERS % Success	SUBSEQUENT SEMESTERS Mean Grade	DEVELOPMENTAL TOTAL n	DEVELOPMENTAL TOTAL % Success	DEVELOPMENTAL TOTAL Mean Grade	COLLEGE-WIDE (Fall 1990) % Success	COLLEGE-WIDE (Fall 1990) Mean Grade
Psychology 130	154	64.3%	1.96	90	56.7%	2.32	244	61.5%	2.08	74.7%	2.61
History 140	20	90.0	2.61	28	67.9	2.26	48	77.1	2.41	78.6	2.85
History 141	25	60.0	2.42	37	62.2	2.22	62	61.3	2.30	71.6	2.53
Sociology 122	33	69.7	2.39	70	64.3	2.26	103	65.0	2.06	70.5	2.43
Humanities 122	63	85.7	2.16	60	61.7	2.26	123	74.0	2.20	76.1	2.75
English 121	n/a[b]	n/a[b]	n/a[b]	353	69.7	2.27	353	69.7	2.27	77.7	2.63

Notes: [a] "SAME SEMESTER" means the "related" course was taken during the fall 1986 semester. "SUBSEQUENT SEMESTERS" includes information on courses taken during any semester between spring 1987 and fall 1990. "DEVELOPMENTAL TOTAL" is a summary of all data on related courses taken over the four-year period. "COLLEGE-WIDE" provides data on the successful completion rates and grades achieved in the college as a whole by all students taking the course during the fall 1990 semester. The n refers to numbers of students enrolled in each course.

[b] ENGL 121 could not be taken concurrently with developmental courses in English.

Average grades earned in what were identified as "English-related" courses were generally at a C-level or above, regardless of the semester the work was completed (see Table 9). Thus, related courses taken during the fall 1986 semester when the first developmental course was also taken resulted in mean grades ranging from approximately C to close to C+ or B- (1.96 in Psychology 130 to 2.61 in History 140; see data under "Same Semester" heading). Mean grades in English-related courses continued at roughly the same levels during subsequent terms (see data under "Subsequent Semesters" heading). The mean grade-point averages based on English-related courses summed over the four-year period covered by the study reflect consistency as well (see data under "Developmental Total" heading). Compared to college-wide grades in English-related courses, students who took developmental courses achieved somewhat lower mean grades. Nonetheless, the mean grades earned by students in the cohort were within the passing range.

Table 9 also gives successful completion rates for these students in English-related courses. During the fall 1986 semester, completion rates ranged from 60.0% in History 141 to 90.0% in History 140. In subsequent semesters, successful completion rates in those courses ranged from 56.7% to 69.7%. Taken in total (see the data under "Developmental Total"), the successful completion rates of students in the fall 1986 cohort ranged from 61.3% in History 141 to 77.1% in History 140. Thus, students who had taken developmental courses in English had mean successful completion rates in English-related college-level courses that were lower than those college-wide in the same courses, with the exceptions of History 140 and Humanities 122, where completion rates were quite similar.

Finally, the relationship between developmental English grades and those in related courses was examined. The results of this analysis indicated a strong and significant correlation between developmental English and related course grades ($r = .62$, $p < .001$). Thus, students' grades in developmental English are strongly correlated with those earned in college-level "related" courses.

In addition, developmental English grades accounted for a sizeable portion of the variance (38.4%) in those related course grades. It thus seems safe to conclude that the skills students gain in developmental English courses have an important impact on their subsequent academic performance.

MATHEMATICS

The Math Cohort Study

The purpose of this study was to explore relationships between students' performance in developmental math courses, their concurrent and subsequent performance in college-level courses at JCCC in which facility in mathematics was needed, and the duration and outcomes of their association with the college. Three developmental math courses were of interest. MATH 111 (Fundamentals of Math) includes work in computation, numeration, and math applications of whole numbers, integers, fractions, decimals, percents, square roots, measurement, geometry, and linear equations. MATH 115 (Introduction to Algebra) covers fundamental algebraic operations, rational expressions, first-degree equations and inequalities, exponents, rational expressions, linear graphs, radicals, and second-degree equations. MATH 116 (Intermediate Algebra) deals with polynomials, rational expressions, exponents and radicals, equations and inequalities, graphing and systems of linear equations, logarithms, and functions.

Transcripts were obtained for the 1,126 students enrolled in the MATH 111, MATH 115, and MATH 116 during fall 1986. These transcripts were examined for the four-year period betwen fall 1986 and the end of the fall 1990 semester in regard to the following data elements:

1. Grades from any of the three developmental math courses and seven college-credit level courses with curricula related to math which were attempted and/or completed during the four-year period;
2. Degrees or certificates awarded by the end of the fall 1990 semester;
3. The number of semesters in which classes were taken after fall 1986;
4. Semester GPA's earned between fall 1986 and fall 1990;
5. Cumulative GPA (as of fall 1990); and
6. Number of credits earned at JCCC as of fall 1990.

Results of analyses of these data elements describe the major short- and long-term effects associated with enrollment in developmental math courses.

Students' Performance in Math Courses

Data were collected regarding students' grades and completion rates in developmental math courses. In addition, these grades were correlated with those in the subsequent math courses for the students in the fall 1986 developmental cohort who enrolled in them. The results of these analysis are shown in Tables 10 and 11.

Table 10

MEAN GRADES AND SUCCESSFUL COMPLETION RATES IN DEVELOPMENTAL MATH COURSES

Course	Number of Enrollments	% Successfully Completing	Mean Grade
MATH 111	341	67.7%	2.31
MATH 115	424	54.3	2.14
MATH 116	361	57.3	2.32

The data in Table 10 reveal successful completion (i.e., passing) rates ranging from 54.3% (MATH 115) to 67.7% (MATH 111). Mean grades in the three courses were somewhat above a C level.

Table 11

RELATIONSHIPS BETWEEN FIRST (FALL 1986) DEVELOPMENTAL MATH COURSE GRADE AND GRADES IN SUBSEQUENT MATH COURSES[a]

First and Subsequent Course	r	r^2	n
MATH 111 WITH MATH 115	.62	.38	70
MATH 115 WITH MATH 116	.66	.44	118
MATH 116 WITH MATH 171[b]	.76	.58	113

Notes: [a] All correlations are significant ($p < .001$).
[b] Math 171 is College Algebra.

Table 11 provides data on the relationships between grades from the first developmental math courses taken during the fall 1986 semester and those earned in subsequent math courses. The table provides the numbers (n) of students involved in a given comparison; the correlation coefficients, r--indicating the degree to which grades obtained by students in pairs of courses are related; and r^2--the proportion of the grade earned in the subsequent math course that is predictable from the earlier developmental course grade.

Table 11 can be summarized as showing that strong relationships exist between students' performance in their first developmental course and in later math courses. In short, students who earned relatively high grades in their fall 1986 developmental course continued earn them in subsequent courses as well.

Overall Academic Performance and Progress

Tables 12 and 13 depict the results of several analyses regarding developmental math students' academic performance and progress at the college; these results are summarized below.

Grades and Credit Hours Earned. Table 12 provides data on the mean GPA's earned by students in the cohort as they proceeded through one or more semester's work in both developmental and college-level courses beginning with the fall 1986 semester. Grade point averages were calculated for each subsequent semester's work, based on the appropriate numbers of students from the fall 1986 cohort. Table 12 contains mean grades from successively smaller groups of students--in essence, from those who persisted through several semesters. Clearly, as time went on, fewer members of the cohort continued to take courses at the college. As was the case for students in developmental English, the mean grade point averages of students in the developmental math cohort fell following the fall 1986 semester, then returned to approximately the same level as that in fall 1986. In fact, as the table indicates, only the second and third semester's mean GPA's differed, at a statistically significant level, from the GPA earned during fall 1986. Moreover students who had taken developmental courses in fall 1986 and continued to enroll achieved passing grades, on the average, during all five semesters.

Table 12
DEVELOPMENTAL MATH STUDENTS' ACADEMIC PROGRESS

	Mean	n
Fall 1986 GPA	2.37	805
GPA Next Semester[a]	2.22[b]	694
GPA Two Semesters Later	2.21[b]	534
GPA Three Semesters Later	2.46	419
GPA Four Semesters Later	2.41	310
Overall GPA Through Fall 1990--		
Students in Developmental Math	2.38	805
College-Wide Fall 1986 Entering Population	2.75	3,608
Credit Hours Earned Through Fall 1990--		
Students Taking Developmental Math	19.55	805
College-Wide Fall 1986 Entering Population	14.20	3,608

Note: [a] Enrollment in semesters following the fall 1986 developmental course may not have been continuous and may have been interrupted by stopping out for some students.
[b] Each semester GPA was compared to the fall 1986 overall GPA using *t*-tests. Noted means are significantly lower than that initial GPA ($p < .01$).

Table 12 also conveys information on the academic progress through the end of the fall 1990 semester available for 805 students receiving grades in one of the three developmental math courses in fall 1986. Across that four-year

period, these students accumulated an average of 19.55 credit hours and a mean cumulative GPA of 2.38. Again by comparison, the total of all 3,608 new students entering JCCC in fall 1986 (including those who took developmental courses and those who did not) had earned an average of 14.2 credit hours and an average cumulative GPA of 2.75 by the end of fall 1990.

Graduation. Table 13 contains data showing that of the 1,126 students enrolled in developmental math courses in fall 1986, 162 (14.39%) graduated (i.e., received a degree or certificate by the end of the fall 1990 semester). This is slightly less than double the overall college-wide graduation rate of the fall 1986 entering student population at the college. While impressive, it is once again important not to over-interpret this finding in light of the earlier discussion of the low proportion of students who enter a two-year college with an intent to graduate.

Table 13

GRADUATION RATES--DEGREES & CERTIFICATES EARNED AS OF FALL 1990--
FOR STUDENTS ENROLLED IN FALL 1986 DEVELOPMENTAL MATH

	Number of Students Graduating	Total Fall '86 Enrollment	% Graduating Fall '90
Students Taking Developmental Mathematics Course Work	162	1,126	14.39%
College-Wide Entering Population (Fall 1986)	272	3,608	7.54

Performance in Related College-Level Courses

Table 14 contains information on the successful completion rates and mean grades earned by the fall 1986 cohort during the four year period of the study in college-level courses with curricula considered related to developmental mathematics. The math-related college-level credit courses identified were CHEM 122 (Principles of Chemistry), DP 124 (Business Data Processing), ECON 230 (Economics I), PSCI 120 (Physical Science), BIOL 122 (Principles of Biology) and BIOL 123 (Principles of Biology Lab), and MATH 171 (College Algebra). The math content of chemistry, physical science, and economics courses should be evident. The math content of the biology courses and data processing may require some elaboration. Instructors of biology, in responding to questions concerning math content in those courses, noted a number of examples of work calling for facility in math. These included calculations in genetics, conversions of inches to meters and decimals to fractions, calculations of percentages, proportions, frequencies, and ratios, solving simple algebraic expressions, measurements associated with using equipment (e.g., microscopes), and sampling techniques and measurements in laboratory exercises. The math content in data processing includes working with simple spreadsheets--some contain accounting examples--and the use of formulas to generate information.

Table 14

MEAN GRADES & SUCCESSFUL COMPLETION RATES
IN COURSES RELATED TO DEVELOPMENTAL
MATH[a,b]

"Math-Related" Courses	SAME SEMESTER n	SAME SEMESTER % Success	SAME SEMESTER Mean Grade	SUBSEQUENT SEMESTERS n	SUBSEQUENT SEMESTERS % Success	SUBSEQUENT SEMESTERS Mean Grade	DEVELOPMENTAL TOTAL n	DEVELOPMENTAL TOTAL % Success	DEVELOPMENTAL TOTAL Mean Grade	COLLEGE-WIDE (Fall 1990) % Success	COLLEGE-WIDE (Fall 1990) Mean Grade
Chemistry 122	22	36.4%	2.40	31	64.5%	2.25	53	52.8%	2.30	75.7%	2.83
Business DP 124	17	52.9	2.00	47	51.1	2.26	64	51.6	2.19	79.3	2.93
Economics 230	61	45.9	2.36	122	56.6	2.13	183	53.0	2.22	72.2	2.51
Phy. Sci. 210	18	66.7	2.57	34	88.2	2.59	52	78.8	2.56	n/a	
Biology 122	24	75.0	1.87	32	71.9	2.26	56	73.2	2.09	73.4	2.47
Biology 123	15	80.0	2.15	25	84.0	2.43	40	73.2	2.33	83.4	2.97
Math 171	n/a[b]	n/a[b]	n/a[b]	266	61.3	2.41	266	61.3	2.41	63.5	2.43

Notes: [a] "SAME SEMESTER" means the "related" course was taken during the fall 1986 semester. "SUBSEQUENT SEMESTERS" includes information on courses taken during any semester between spring 1987 and fall 1990. "DEVELOPMENTAL TOTAL" is a summary of all data on related courses taken over the four-year period. "COLLEGE-WIDE" provides data on the successful completion rates and grades achieved in the college as a whole by all students taking a course during the fall 1990 semester. The n refers to numbers of students enrolled in each course.

[b] MATH 171 cannot be taken concurrently with developmental courses in math.

As shown in Table 14, the mean grades earned in math-related college-level courses during the same semester as the first developmental course were, with one exception, at or slightly above a two-point (C) average. The mean grades earned in math-related courses during subsequent semesters were slightly higher than those attained during the fall 1986 semester. Taken in total (see the columns under "Developmental Total"), over the four years covered by the study, developmental students earned mean grades that were consistently above a C average in these math-related courses. However, these grades were consistently lower in the math-related courses than those earned by the college's student body as a whole (see the far right columns of Table 14 under "College-Wide"), with the exception of MATH 171. In sum, students who were enrolled in developmental courses did passing work in the math-related courses they took, but they achieved lower average grades than did students in those courses college-wide.

Successful completion rates in the seven courses related to developmental math during the first semeser of the study ranged between 36.4% in Chemistry 122 and 80.0% in Biology 123. Over the entire four-year period covered by the study, passing rates (i.e., successful completion rates) ranged between 51.6% in Business DP 124 and 78.8% in Physical Science 210 (see columns under "Developmental Total," Table 14). Except in the case of Math 171, the successful completion rates of students who had taken developmental math courses were somewhat lower that those of the college-wide student population in those courses (see far right columns under "College-Wide," Table 14).

Table 15 summarizes the relationships between grades in developmental math courses taken during the fall 1986 semester and the mean of a given student's course grades in all related college-level coursework. Thus the mean grade in the seven related courses is based on a student's work in every related course

Table 15

RELATIONSHIP BETWEEN DEVELOPMENTAL MATH COURSE GRADES AND GRADES EARNED IN RELATED COLLEGE COURSES (FALL 1986 TO FALL 1990)

	Relationship with Related Courses		
Developmental Course	r^a	r^2	n^b
MATH 111	.65	.42	59
MATH 115	.59	.35	133
MATH 116	.64	.41	230

Notes: [a] All correlations are significant ($p < .001$).
[b] "n" refers to the number of grades.

taken either in fall 1986 or after. As the table indicates, the correlations between grades in developmental courses and those in related, college-level courses are sizable and statistically significant. The data can be summarized by noting that students' grades in developmental math courses are clearly

related to those achieved in related college-level courses. Similar to the findings from the English cohort study, grades in developmental math accounted for a large portion of the variance (35% to 42%) in related course grades. Once again, this indicates that the skills students gain in developmental math courses play an important role in their subsequent academic performance.

CONCLUSIONS AND IMPLICATIONS

The results of the studies reported here suggest several major conclusions. Overall, developmental courses at Johnson County Community College seem to be successful in a number of areas.

1. Students in developmental reading and English courses demonstrate real gains in achievement, at least as measured by scores on standardized tests.

2. In general, the majority of students in these courses complete them with average grades in the C range.

3. It is apparent that students enroll in these courses for various reasons, including acquisition of functional literacy skills and preparation for college-level coursework. More than 70% of the students in the developmental courses examined in this paper enrolled for at least one semester after taking a developmental course. This finding indicates that a large majority of students in developmental courses enroll in additional coursework at the college, much of it at college level.

4. These students achieved passing grades in college-level courses related to their developmental course. However both their grades and successful completion rates were generally lower than the overall college averages for those related courses.

5. Graduation rates of students in developmental courses range from roughly half to twice the level of the student body as a whole.

The results of English and math cohort studies also suggest some specific conclusions. Taken together, the results of these studies indicate that the cohort of students enrolling in and successfully completing one or more developmental math or English courses in fall 1986 was also able to do passing work in related courses, both developmental and college-level. These students attained higher success rates and GPA's in humanities and social sciences than in mathematics and science courses. For the most part, however, those in these cohorts who did passing work--particularly those receiving A's and B's in developmental courses--were also able to perform at acceptable levels in college-level courses. Two additional points should be noted, however:

1. Those students taking developmental math courses, particularly MATH 111, appear to have a more difficult time completing math-related courses than the college's students generally. Completion rates were particularly low in CHEM 122, DP 124, and ECON 230.

2. On the other hand, it appears that students who have completed developmental work in math can cope quite well with courses in physical science, biology, and MATH 171 (College Algebra).

One possible implication of the findings on completion rates in math-related courses is that students in developmental math courses should probably not attempt work in chemistry, business data processing, or economics until they have taken the required and appropriate developmental courses, even though current college policies permit concurrent enrollment. Even then, unless the

students did quite well (i.e., earned a B or better) in those developmental courses, it is possible that they will have some difficulty in successfully completing the college-level courses noted above.

Successful completion rates in English-related courses (i.e., humanities and social sciences), while generally higher than those in math-related courses, were still below the overall completion rates of the college's students generally in those courses. Overall, however, the data for English-related courses seem to indicate that students taking developmental courses can and will do adequate work in these courses, even if taken concurrently with ENGL 106.

The GPA's of students in both cohorts dropped significantly after the initial fall 1986 semester. Grade point averages then rose during the next several semesters of coursework until they were comparable to those earned during the fall 1986 semester. This latter finding may be, in part, an artifact of attrition among students who had lower levels of achievement in those subsequent semesters. In any case, it appears that students who are able to achieve passing grades in developmental courses can also succeed in college-level coursework, probably improving their GPA's as they accumulate college-level credit.

Comparison of the data from students in the developmental reading study provide some interesting bases for contrasts. In that study, students appeared less likely to continue on and succeed in college-level courses than students who took developmental math or English. Thus it appears that students required to take courses in developmental reading may differ substantially in levels of readiness for college-level work and/or may represent a substantially different population than those requiring remediation in math and English. For this reason, the college may want to devote additional attention, in terms of tracking and support services, to students deficient in reading. It may also be in the college's and students' best interest to offer individuals with deficiencies in more than one of these areas additional support to enhance their chances for success.

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